by the cellular picture of the liver, or (b) an increased liberation of hæmoglobin by hæmolysis.

Regarding the etiology of the disease we know nothing. Tilleston divides hæmolytic jaundice into two types, cryptogenetic and secondary. Our case obviously falls within the first group. Why the child should have bled so freely and uncontrollably we are at a loss to explain. We do know that in some severe infective types of jaundice hæmorrhages do occur. In this case there were no demonstrable signs of infection. It is possible that the jaundice may have been complicated by the presence of hæmorrhagic disease of the newborn.

What type of treatment we should suggest if it were our fortune to see such another case is difficult to state with any assurance of success. Immediate transfusion, or exsanguination transfusion, is certainly indicated, and possibly an early splenectomy.

ABDOMINAL PAIN IN CHILDREN IN EXTRA-ABDOMINAL CONDITIONS*

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PAIN, being a purely subjective symptom, we are dependent for our knowledge of its nature upon the ability of the patient to give us exact information. It follows, therefore, that precise knowledge concerning the nature and severity of pain in young infants must be very meagre indeed, and that unless our methods of examination can be considerably perfected, we shall remain in the dark concerning pain, referred and otherwise, in infants under two years of age, more than to infer from the actions of a child that he is in pain. Even in older children, where attempts are made to localize pain, it is often with the greatest difficulty that exact localization can be made possible. It is easier to elicit tenderness, than to elicit a statement concerning the exact localization of pain. In dealing with pain in its relation to disease in children, therefore, the difficulties which arise seem well-nigh insurmountable. Particularly are the difficulties great when we endeavour to localize a pain to a certain point. The child with a sore throat will, when he complains of pain at all, often say that his neck is sore, or a child with earache, merely that he has pain in the head.

Hilton said many years ago, that when a patient is suffering from pain in any part, he instinctively believes that he must be suffering from inflammation of that part, and he emphasized the fact that pain is not by itself an indication of an inflammatory state, for it may exist without any inflammation of a part complained of. Nothing is more natural than for the patient, or the parents, to assume that the seat of the pain is the seat of the disease, and nothing is more common than to find symptoms of severe pain quite remote from the seat of the disease. Pain does not always depend on disease of the painful part. It depends rather on stimuli reaching the brain from afferent nerve fibres. A child may have pain in his legs, and disease in the spinal cord, or pain in his abdomen, and disease in his chest. One experiences, in practice, so many instances of pain remote from the seat of disease that it has seemed fit to take stock of a few experiences in this connection, especially with reference to abdominal pain associated with disease outside the abdomen. The importance of fuller knowledge of such conditions can hardly be over-estimated, particularly with reference to the abdomen, where one is apt to be misled into believing that acute abdominal disease actually exists, or conversely to overlook a true intra-abdominal con-

* Read at the fourth annual meeting of the Canadian Society for the Study of Diseases of Children, Gananoque, Ont., June 11, 1926.

dition, in the belief that the real disease is elsewhere.

The frequency of the occurrence of abdominal pain with pneumonia, particularly of the lower lobes, is too well known to require more than mere mention. So too in pericarditis, as well as with pleuritic effusions, abdominal pain as a concomitant symptom is well recognized. When we come, however, to consider the occurrence of such pain as symptoms associated with conditions of the upper respiratory tract, we find but meagre reference in the literature, and scant general knowledge concerning such an occurrence, yet the frequency of abdominal pain with the less severe and less significant infections of the throat, nose and ears, is far greater than is its occurrence with either pneumonia or pericarditis.

It is desirable, therefore, to discuss abdominal pain in children, first, in relation to sore throat and allied upper respiratory conditions, and secondly, in relation to the more important conditions referring to the thorax.

Abdominal pain is rather a common complaint in children, much as headache is in the adult. Children are very apt to refer any pain to the abdomen. Many writers on abdominal pain in children have made brief reference to the fact that pain in the abdomen is not infrequently complained of in the course of throat infections. Adams[1] for instance, mentions that the specific fevers often have a pseudo-abdominal onset, while Myers[2] mentions the association of abdominal pain with tonsillitis. Brennemann[3] however, has called more detailed attention to this incidence, and has offered the suggestion, on the basis of several cases in which the extreme severity of symptoms seemed to justify laparotomy, that the cause of pain was truly in the abdomen, because in these few cases in which the abdomen was opened, acute mesenteric adenitis was actually found.

In the usual winter series of upper respiratory infections seen in private practice, one encounters numerous instances of simple influenzal nasopharyngitis in which the onset is with fever, with or without vomiting, and with abdominal pain. The pain is frequently the first symptom noted. It is seldom severe, and is usually, as even with many actual abdominal conditions in children, referred to the umbilicus. Tenderness is the exception rather than the rule. The pain lasts for about twenty-four hours and disappears usually long before the chief condition itself has subsided. An ordinary physical examination in these cases at once reveals the true nature of the ailment. The throat is flaming red, the nasal mucous membrane is congested, and often the ear drums show a small amount of catarrhal inflammation. The question of trouble within the abdomen does not arise in the mind of the physician.

Such instances of moderate abdominal pain at the onset of a throat infection are in some epidemics extremely common. Just as in some years otitis media, and in others adenitis, become the most common complicating conditions, so too do we many times see entire groups of cases in which at the onset the abdominal pain dominates the picture for a few hours. Occasionally the pain is of considerable severity, and if accompanied by vomiting, may at first blush give the impression of a true abdominal pain. For instance: a boy of six years of age began to complain of severe abdominal pain. He vomited once. The temperature at the onset was 101°. He was seen within the first three hours after the onset. The temperature was 103°, the pulse was rapid, the face flushed, the abdomen was not distended. Pain was definitely referred to the umbilicus, severe, cramp-like, spasmodic. There was some abdominal tenderness and rigidity of the entire abdomen. The anterior cervical glands, however, at the angle of the jaw were a little enlarged, and somewhat tender. The tonsils were enormously swollen, with a great deal of follicular exudate, and no complaint, even on direct questioning, of sore throat.

Such instances could be multiplied many times, not only in infections which remain localized to the throat, but also in others where the tonsillar symptoms are not severe. In many cases of influenza, in measles, in scarlet fever, whether mild or severe, abdominal pain is frequently encountered.

It is hardly conceivable that all of these cases can be explained by the suggestion of Brennemann, namely, that an inflammation of the abdominal lymph nodes exists coincidentally with the throat infection and that therefore the pain has its origin in true intra-abdominal disease. It is difficult to correlate such a view with the usual clinical symptoms in such cases. It is

scarcely possible that a child with acute mesenteric lymphadenitis would recover completely with a disappearance of all abdominal symptoms within twenty-four to thirty-six hours after the onset. The frequent absence of tenderness and rigidity argues against such a view. Nor is it likely that such an associated condition would almost invariably subside, either before, or coincidently with, the subsidence of the primary throat infection. One is inclined rather to the inference that the abdominal pain is merely a remote echo of the trouble in the upper respiratory tract.

I believe that we can divide into two groups the cases of throat infection, in which abdominal pain is encountered. In the first, and by far the largest group, the pain is the first and the outstanding symptom, rarely accompanied by tenderness, and almost never by rigidity. In these the pain subsides well before the signs in the throat subside, and no diagnostic difficulty is encountered.

In the second group the pain occurs after the onset, and sometimes after the complete subsidence of the throat infection. Here the severity is much more marked, and tenderness, though rarely rigidity, is a feature. These cases, I believe, could very well fit in with Brennemann's explanation of adenitis.

A child three years old, had had tonsillitis about four days prior to the onset of severe abdominal pain. When seen, the child was in a severe paroxysm of pain, holding the abdomen, and doubling over. There was a desire to move the bowels, but without result. The temperature was not elevated. The throat was still red, the pulse 120. Urine contained neither albumen nor pus. The abdomen was not distended, there was general tenderness more marked over the lower half. Rectal examination was negative. Under hot compresses, and a little paregoric, the pain gradually subsided.

I have seen three cases somewhat similar to the one just cited. In these it is quite conceivable that a mesenteric adenitis was responsible for the pain. It is easy to see how in such a case, with the continuation of symptoms, one might be tempted to suggest laparotomy, as did occur in some of the cases reported by Brennemann.

These two groups rarely leave one in doubt as to the true nature of the condition. Their interest lies chiefly in our ignorance of the true reason why a child, with a throat infection, should complain of pain in the abdomen; why, with severe sore throat, and tender cervical glands, these children should not complain of their throats even on direct questioning, and refer all their pain to the abdomen. One might offer an hypothesis based on the mechanism of reflex radiation of pain as suggested by Mackenzie. Such an hypothesis would not explain why the referring of pain from the throat to such a distant part should occur in children, and not in adults, except possibly on the basis of the immaturity of the nervous development, and hence the very poor ability of children to localize pain generally.

The practical importance of these phenomena lies in this fact: that we must recognize that abdominal pain may occur in children as a symptom of throat infections, and that it is usually of little significance, and, except in rare instances, is not a sign of disease within the abdomen.

We have to consider another group in which the differentiation from true intra-abdominal disease is not quite so easy. I refer to cases of intrathoracic disease in which abdominal symptoms predominate. Such instances are by no means uncommon, either among adults or among children, but they are by far more common among the latter. I have already referred to cases of abdominal pain associated with lower lobe pneumonia, or with diaphragmatic pleurisy. Even these offer, at times, great diagnostic difficulties to the physician, despite the fact that he is well aware of the association. It is not only these types of pneumonia and pleurisy that are associated with abdominal pain. For instance, a child with a right apical pneumonia suffered for two days with severe abdominal pain, but the flushed cheeks, the dilating *alæ nasi*, and the short hacking cough, left no doubt as to the true nature of her disease. Here the usual explanation of pain referred along the lower intercostal nerves could scarcely hold. In such a case, the explanation of the cause of the abdominal pain must be of the same nature as would obtain in the instances of pain associated with sore throat. These will be discussed presently.

Two cases of empyema, in which the abdominal symptoms were so severe and so dominant that

the diagnosis of peritonitis was seriously considered, are of interest in this connection.

A girl four years old, who for two years had had a profuse vaginal discharge, which had its origin in a gonorrhœal infection contracted from the mother, took ill suddenly with intense pain over the entire abdomen, vomiting, and fever. I first saw her early one morning, and found her pale and almost collapsed, with a weak pulse, and respiration 30. The temperature was 102°. Examination of the thorax was negative. The child was screaming with pain, sharp shrill cries, much like I have heard in some children with pneumococcus peritonitis. The abdomen, though not much distended, was of board-like rigidity, and hyperæsthesia was so marked that she could not bear the slightest touching even of the skin of the abdomen. She was admitted to the hospital with a diagnosis of peritonitis, probably gonococcal. On admittance it was noted, after prolonged observation, that the abdominal rigidity relaxed for short intervals, when a fairly satisfactory examination of the abdomen was possible. On the basis of this intermittence of the rigidity she was left alone and watched. White blood corpuscles were 24,000, pulse 128, respiration 30. The next morning it was obvious that there was a patch of consolidation at the angle of the scapula on the left side, and a pleural friction at the base on the same side. The abdominal symptoms persisted intermittently for several days. By the fifth day a fair sized effusion had developed, which, on thoracentesis, revealed thin greenish purulent fluid, which on smear showed streptococci. After rib resection and drainage, recovery was uneventful.

The other case was that of a girl, four and a half years old, who was admitted to the hospital after having been ill for two weeks. Her illness began with pneumonia, which lasted but three days. Temperature remained normal two days, then rose again, and continued till the child was admitted to the hospital. On admission, respiratory distress was obvious. There was moderate cyanosis, and the *alæ nasi* were moving. The physical signs in the left chest were obviously those of empyema, but the abdominal symptoms were so exquisite as to cause one to wonder if the thoracic condition was sufficient to explain them. The abdomen was quite distended, boardlike rigidity was again present, and tenderness was extreme. The child could not bear the weight of the bed clothes on the abdomen. Pneumococcus peritonitis, directly associated with acute abdominal condition, or empyema, is by no means common, but here indeed the entire clinical picture, despite the known presence of empyema, was definitely that of acute abdominal condition. The white blood corpuscles numbered 55,000. Here again, as in the other case, all the abdominal symptoms subsided after drainage and recovery was again uneventful.

These illustrations will suffice to show how readily pain in children may be referred to the abdomen, and how at times one may be not a little puzzled as to the real seat of the disease.

A third case, which came under my notice recently, was that of a boy seven years of age, who had been ill for three weeks with pain in the right side of the abdomen, and temperature never higher than 101°. The child localized the pain to the right iliac fossa. Until two days previously, he had been unable to turn on his right side. Examination revealed a little rigidity, and a little tenderness, in both upper and lower quadrants on the right side, but no point of maximum tenderness. Examination of the thorax revealed an effusion as high as the second rib.

Here are three cases illustrative of the association of abdominal pain with disease in the thorax. In two of them the nature of the trouble was evident on examination. In one, on the other hand, the entire staff was frankly puzzled for a number of hours, and the decision to await developments was reached only after repeated examinations.

The explanation of abdominal pain, in these various groups of conditions, is far from obvious. The occurrence of abdominal pain, so severe even as to simulate an acute abdomen, is not confined to children alone. Pringle[4] for instance, has reported two cases of intrathoracic catastrophes simulating the acute abdomen, in one case due to rupture of the left subclavian artery, and in the other to thrombosis of the left coronary artery.

Three distinct possibilities present themselves which might explain abdominal pain in extra-abdominal disease. The first and best known explanation, with reference to disease within the chest, is that of a referred pain along the lower

thoracic nerves, in conditions involving the lower part of the thorax, such as lower lobe pneumonia, and diaphragmatic pleurisies. The second one of the possible explanations of referred pain in remote infections, as in the throat, where such direct relations with nerve trunks cannot be demonstrated, might be that sensory pain impulses initiated in the pharynx, and travelling up to the medulla, arrive at the sensory nucleus of the vagus and glosso-pharyngeal nerves; from here, the impulses are transmitted to the gastro-intestinal tract, causing hyperperistalsis, possibly to the extent of spasm. Spastic contraction of the intestinal tract is known to cause abdominal pain, and under certain conditions, also spasticity of the abdominal wall muscles and tenderness of the abdominal skin. These phenomena are also to be explained by the transmission of sensory impulses from the gut along the sympathetic fibres to the grey matter of the cord, where the impulses are spread to the adjacent cells, which send sensory pain impulses upwards to the brain, and motor impulses to the muscles of the abdominal wall. On the other hand, it is also possible that the sensory pain impulses from the throat reaching the vagus and glosso-pharyngeal nucleus in the medulla, may thence be radiated directly to the areas for the appreciation of pain in the cerebral cortex. This latter explanation would seem to fit those instances in which abdominal pain exists without tenderness or spasticity of the abdominal wall. The inability of children to localize pain, as well as the immaturity of the nervous development generally, could in this manner, lead to pains which arise in the pharyngeal and tonsillar areas being referred to the abdomen. Thus a cause for the production of pain in the throat can find expression in pain, and sometimes muscular rigidity, of the abdomen, by way of reflex radiation of the sensory impulses which it initiates.

A third possibility which we have to consider in this connection is the effect of the toxæmias *per se*, on the musculature of the intestine. Joint pains, headaches, pains over the eyeballs, and skeletal muscle pains, are certainly very common in upper respiratory infections. These are obviously toxic in origin, and it is conceivable that such toxins would have an irritating effect either on the nerve elements supplying the intestines, or on its musculature, and in this way cause painful stimuli to reach the brain from this source.

One cannot attempt to do more than offer such hypothetical explanations as the causes of the associations of abdominal pain with extra-abdominal conditions. It is important for us to recognize its existence, and its various manifestations, and perhaps, with the greater development of our knowledge, to discover the true mechanism by which such phenomena occur.

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The Principles of Hæmotological Differentiation.—A. Piney maintains that it is possible to arrange leucocytes into classes according to their nuclear structure. In one class, which includes polymorphonuclear leucocytes, myelocytes, pre-myelocytes, myeoblasts, and monocytes, the basi- and oxy-chromatin are sharply marked off from one another; while it is diffusely mingled in a second class, in which are placed lymphocytes, Turk cells, plasma cells, and lymphoblasts. The cells of the first class are liable to extreme nuclear contortion with increasing maturation, while those of the second class show very little polymorphism. The first class is characterized, except in the case of the most immature myeloblasts, by the presence of oxidizing enzymes, which are not found in cells of the second class. Recognition of the lymphatic nature of a cell is possible from its structural appearance. Piney believes that the conception of a common ancestral blood cell (lymphoidocyte) has resulted from failure to appreciate the fine structural differences between the lymphoblast and the myeloblast, and that the common parent must be sought further back.—*Journal of the Royal Microscopical Society*, June, 1926.